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ABSTRACT

The paper discusses research and research applications regarding the exceptional child and the physical environment, and presents ways in which space can have an impact on learning and development. An argument is made for the creation of research based design principles based on knowledge of the relations between the physical environment and the development of the exceptional child, and for testing these theoretical concepts in field situations. To illustrate the argument and to show what can be done to make better play/learning environments, two examples of empirically based design principles are discussed and examples are given of the application of these concepts to the design of an outdoor play/learning environment for exceptional children. A number of working hypotheses about the relation between the physical environment and development are advanced, and research is called for to test these hypotheses in the context of field situations. It is argued that in this way research and design can best contribute to each other and to applied research and research applications regarding space and the exceptional child. (Author/SBH)

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THE APPLICATION OF RESEARCH TO THE DESIGN OF THERAPEUTIC PLAY ENVIRONMENTS FOR EXCEPTIONAL CHILDREN

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Abstract

The purpose of this paper is to discuss research and research applications regarding the exceptional child and the physical environment and ways in which space can have an impact on learning and development. An argument is made for the creation of research-based design principles based on knowledge of the relations between the physical environment and the development of the exceptional child, and for testing these theoretical concepts in field situations. To illustrate the argument and to show what can be done to make better play/learning environments, two examples of empirically-based design principles are discussed and examples are given of the application of these concepts to the design of an outdoor play/learning environment for exceptional children. A number of working hypotheses about the relation between the physical environment and development are advanced, and research is called for to test these hypotheses in the context of field situations. It is argued that in this way research and design can best contribute to each other and to applied research and research applications regarding space and the exceptional child.

The Design of Therapeutic Play Environments for Exceptional Children

The purpose of this paper is to open an area of much needed discussion, research, and research application on how the physical environment may contribute to the development of the exceptional child.

An argument is made for the development of research-based design principles based on knowledge of the relations between the physical environment and the development of the exceptional child, and for testing these theoretical principles in field situations. To illustrate the argument, two examples of empirically-derived design principles are discussed and examples are given of the application of these theoretical concepts to the actual design of an outdoor play/learning environment for the St. Francis Children's Activity and Achievement Center in Milwaukee.

Scope and Importance of the Topic

There are three reasons why the issue of the relationship of exceptional eduction to the physical environment should be investigated. First, the plight of handicapped children--both physically and mentally handicapped--has led to a major national and international committment to programs for early diagnosis and education. During the last decade there has been a remarkable growth of professional interest in the preschool education of exceptional children. This interest in part derives from the findings of Hunt (1961), Piaget (1963), Kirk (1972) and others which suggest that the preschool years are of great importance developmentally for all children. The magnitude of this problem is not minor: at the time of the last national census, 1970, there were approximately 1 million preschool children and another 6 million school age children who suffered from a handicapping

condition preventing them from participating easily or fully in school and society (Martin, 1971; Melcher, 1977). Estimates are that at any point in time, 7.5-8.5% of the school age population require some form of special program for a developmental disability (Melcher, 1977).

Second, there is a growing interest among people who work directly with exceptional children--teachers, parents, therapists, and other professionals--in the role of physical space in helping children to overcome developmental disabilities (cf. Rho and Drury, n.d.). This is a double-sided issue, however, as many educators and child psychologists have believed that only the social environment, not the physical, is important in learning, while others have had the feeling that the physical environment plays a very important role. Nevertheless, among the latter group, there has been little available research findings and emprically-based design criteria on which to base judgments about which aspects of space matter and which are superflous.

Third, there is now considerable evidence from the emerging interdisciplinary field of environment-behavior studies, and from the study of child-environment relations in particular, that space does play a role in general education (e.g., David and Wright, 1974; Coates, 1974), and this leads naturally to the assumption that space indeed also plays a critical role in the development of children with learning and other developmental disabilities.

The questions thus arise: What is the role of space in the learning of the exceptional child? What particular environmental variables are critical? And how can we conceptualize their impacts?

Since the exceptional child is constantly engaged with the physical environment as part of any interaction with a parent or professional, and as he or she often has some difficulty adapting to that environment, exceptional education research and theory--and architectural practice--are obliged to give consideration to the tole of the environment in development. Not only

may the environment operate directly to affect development and exceptional education, but the total environmental setting--both physical and social--also provides or withholds the resourses staff, parents, and child find it useful to call upon. Said differently, the environment may exert a direct therapeutic effect on exceptional children, or it may provide or not provide settings conducive to the functioning of different educational programs. Some authors have advocated the first or therapeutic view (e.g., Bayes, 1967), while others have taken the second, more moderate, environment as mediator view (e.g., Sanoff, 1977).

Based on one or the other of these two positions--most often held implicitly, without analysis--designers have recently begun to recommend a range of criteria for the design of environments for handicapped children (e.g., Texas A&M University, 1969; Bednar and Haviland, 1969; Bayes and Francklin, 1971; Waligura and Thompson, 1969; Ontario Department of Education, 1971; Nellist, 1970; Shaw, forthcoming) and to show examples of their work which they think meets the needs of handicapped children (e.g., Sandhu and Jansen, 1974; Rho and Drury, n.d.).

But very little of this previous work has been emprically-based; even less is evaluated in use. Design wisdom and a casual look 'round often substitute for what should be careful, empirical evaluation. There are notable exceptions to this rule, of which Shaw and Robertson's work (Ref. Note 1) to developing an environmental analysis test is a prime example. Furthermore, direct empirical evidence to date on the role of the physical environment in exceptional education is so sparse as to make support very difficult. Thus most statements about the role of space in the learning of developmentally disabled children and most criteria for the design of environments for exceptional children are based on experience, unsubstantiated

by systematic research.

The position is taken here that the experience of good designers and design theoreticians can become the basis for research hypotheses and that the results of applied empirical research provide the basis for the development of new design criteria and design applications. Thus we have been advocating--and our research, professional applications, and teaching are directed toward--a collaborative effort between applied researchers and behaviorally-oriented designers to develop a body of empirical knowledge about child-environment relations and their application to exceptional education, to derive new design criteria based on that knowledge, and to evaluate completed designs either in the field or in controlled experimental situations. There are many new empirical studies on various aspects of child-environment relations (cf. R. Moore, 1974; Altman and Wohlwill, 1979), but these have not looked at the physical environment and exceptional education. At the same time, there are many creative designers applying their hunches and insights to the design of new environments, but these are seldom tested.

It is my position that research and design can operate in a feedback loop, and that every design decision is based on an implicit hypothesis about how children will react to their environment. Therefore, it is testable. My position is also that a body of empirical research and theory are necessary in order to more rationally base design interventions on empirical evidence. Therefore, as Leland Shaw also states (Shaw and Robertson, n.d.(b)), as designers as well as as researchers, we are fundamentally concerned with a empirical basis for design and with research that aids the design professional in solving problems. The cycle of research-design-evaluation which we have therefore proposed is shown in Figure 1.

Insert Figure 1 about here

A Cognitive-Developmental Model

To underlie both applied research and research applications in exceptional education and the environment, it is necessary to begin with the articulation of a general theoretical position about development and the environment. In past research and application, the most neglected area has been the absence of systematic concern for an overall conception of how the physical environment and child development interact. Portions of such a theory have been sketched in earlier works (Moore, 1976; cf. Altman and Wohlwill, 1979), and will not be repeated here. Space does not permit the full development of a theory here, so only the most important assumptions about child-environment relations will be outlined.

Environment is a very broad term, encompassing many meanings. It's meaning ranges from distant events (e.g., landscapes, population densities in a city) to those that are quite immediate (the shape or complexity of a room, number of people in a room). As has been pointed out by many others (cf. Lazarus and Cohen, 1977), there is no logical or theoretical reason to separate the physical from the social environment. Events occur in a total context--a mileau. Though designers can only directly manipulate the physical environment, any comprehensive theory of child-environment relations must include the total ensemble of the social and physical environment.

A strict causal model of independent environmental variables acting on dependent person variables is not likely appropriate--at least at this stage of the development of theory and research--to the understanding of child-environment relations. Careful observations and systematic description must precede explanation. At this point in time, an ecological model

where the total ensemble of social and physical variables are related holistically with person--child--variables seems more appropriate than a strict cause-effect model. Such an approach also focuses on the processes mediating between variables (such processes as the child's cognitive structuring of the situation and the role this plays in his or her total behavior and development; cf. Moore, 1976). How the total collection of variables interact in an ongoing transaction between the child and the environment must be our first concern.

With regard to development, a cognitive-developmental approach is favored for a variety of reasons over any other single theoretical position (see Moore, 1976; Moore and Shaw, Note 2). Looked at developmentally, the physically handicapped, learning disabled, or mildly retarded child is not basically different from other children. Certain developmental differences do stand in the way of average rates of development, but as Kirk (1972) has shown, there are more similarities between the exceptional child and the average child than there are differences. The pattern of intra-individual differences is what must interest us if we are to aid development of the full child. But the stages of development are the same for all children; certain developments are only more difficult for the developmentally disabled child. The implication for environmental design clearly is that every design decision must be thought our more carefully so that the environment can pace developmental progressions from sub-stage to sub-stage for the exceptional child.

Children learn through a series of interactions with the social and physical environment--the staff, the curriculum, and space. This is a Piagetian position (cf. Piaget, 1963). The child is not a passive being to be bombarded with stimuli. Rather the child is an active agent in his or her own development--exploring, discovering, testing, trying things out, imitating,

fantasizing, and developing--and in all of this, he or she is not only interacting with the social environment of people, staff, and other children, but also with the physical environment. It is through this dynamic interaction with the total social and physical environment and from feedback on his or her actions, that development occurs (Piaget, 1963; cf. also Gordon, 1972; Hart and Moore, 1973).

Major developmental theories--from Berlyne's stimulus-seeking theory applied to play (Ellis, 1973) to Garvey's (1977) social learning theory and Piaget's (1962) cognitive developmental theory of play--all hold that play is integral to development, for it is through unstructured, child-initiated play that the child is often freest to explore, to test, and to learn from feedback on his or her own actions.

Children with developmental disabilities are often over-sheltered by well-meaning parents and staff, and this may hinder development. As Lady Allen (1968) said: "It is important to insure that the handicapped child can have rich, varied, and spontaneous experiences whereever they are." Gordon (1972) advocates that disabled children should be able to experience the natural diversity and change which only the natural out-of-doors can provide.

Finally, looked at in this context, it is absolutely amazing how little traditional playgrounds offer to children and especially to exceptional children. Traditional, fixed-in-place play apparatus supports considerably less cognitive and social play, and children spend considerably less time at them than they do at other types of playgrounds, like adventure playgrounds (Hayward, Rothenberg, and Beasley, 1974). Recent field observations at 26 playgrounds around the United States and Canada have shown that very few existing play environments support the full range of developmental needs of growing children (Cohen, Moore, and McGinty, 1978). Fewer still meet the

needs of exceptional children (Moore, Cohen, Oertel, and Van Ryzin, 1979).

Insert Figures 2 - 5 about here

Empirically-Based Design Criteria

There is considerable evidence, as mentioned above, that the physical environment has a rich impact on learning (David and Wright, 1974; Prescott and David, Note 3; Altman and Wohlwill, 1979). Unfortunately, to date there is less direct evidence about particular environment-behavior relations with respect to exceptional children. This is a much-needed area of basic and applied environmental psychology research. Based on the above general theoretical position, and on an exhaustive review of the research literature, we have been able to derive a series of empirically-based criteria for the design of indoor and outdoor environments for exceptional children. This is what I'll briefly treat in the present section.[1]

A number o other behaviorally-oriented designers have articulated design concepts for play environemnts for mentally and physically handicapped children (e.g., Bayes, 1967; Allen, 1968; Bednar and Haviland, 1969; Gordon, 1972; Shaw, Note 4); these are comparativly reviewed elsewhere (Moore et al, 1979).

Method

Our approach at the University of Wisconsin-Milwaukee has been to develop a range of design criteria arising from a research application and design project for exceptional children. No first-hand empirical research was conducted; rather the project involved the collection of design-relevant research information from a variety of sources and the translation of that information into design guidelines.

User information on the spatial behavior and developmental difficulties encountered in different enviroments by exceptional children was collected and analyzed. Sources included the existing research literatures in exceptional education, architecture-landscape architecture, and environmental psychology (child-environment relations). As very little substantive research has been conducted to date on the role of the physical environment in exceptional education, most of this information was gathered from neighboring fields, making the translation to desig somewhat sepculative. As the exceptional education literature tended to treat the child without considering his or her environmental context, and as the architecture literture tended to treat buildings without any systematic reference to users, the most valuable literature was found to be that in child-environment relations.

Other sources of information included interviews and participatory games with the staff and administration of the St. Francis Children's Activity and Achievement Center in Milwaukee and from informal observation of children at the Center.[2,3]

A set of design criteria was derived from this analysis together with specific user requirements for designing new environments. These criteria have been brought together as a general design guide for play/learning environments--indoor and outdoor--for all handicapped children (Moore et al., 1979). Sample criteria will be presented in the next section.

Finally, an actual design of an outdoor play/learning environment was created for the St. Francis Center to implement the theoretical concepts and--important for research--to provide an opportunity to evaluate their effectiveness in a real field situation.

It must be pointed out, in reference to Figure 1 above, that though these criteria were derived from empirical research, they have not themselves

been tested. They thus have the status of hypotheses, and will be evaluated in a quasi-experiment field situation. The cycle of research and design is not complete until evaluation has been completed and hypotheses either corroborated or falsified and results fed back into additional basic and applied research. In this way, research and design can contribute to each other, design decisions can be research-based, applied research can be oriented by problems facing practitioners, and the whole area of exceptional education and the physical environment can move forward on a firm footing.

Design Principles and User Requirments

To illustrate the above general theoretical and methodological position, let us examine two examples of empirically-derived design principles and their application in a specific design context.

First, what do I mean by the term design principle, and how are they derived from research information?

A major characteristic of our approach to design for handicapped children as it's been evolving at the University of Wisconsin-Milwaukee is the development of what we have come to call design principles. The notion owes a considerable amount to the work of Christopher Alexander and his colleagues in developing what he calls "patterns" (Alexander, Ishikawa, and Silverstein, 1977). Our design principles have certain similarities to patterns, but they also have some intentional differences from them, as I'll show.

Design principles respond to and are derived from an analysis of developmental goals for exceptional children and research informtion articulating these goals and suggesting interactions with the physical environment. In our work, child developmental goals were articulated from the various types of information described above. The summary descriptions of develop-

mental goals, derived design ideas, and the arguments linking the two comprise what we refer to as a generic, behaviorally-based design guide (an example of which is Moore et al., 1979).

We may thus define design principles in the following more precise way:

1. Design principles must respond to critical environment-behavior problems in humanistic terms.

2. They must either provide settings which will enclose but not encumber children's activities and behaviors conducive to the attainment of specified developmental goals or they must more directly be thought to facilitate development goals by direct environmental stimulation.

3. They must generate specific design solutions and must be able to be used in explaining those solutions.

4. They must be based on the latest and best research information.

5. They must be testable.

6. They must be stated in enviromental terms, not behavioral terms, i.e., they must specifiy in what ways the environment is to be designed.

7. They must be intentionally open-ended; they are intended to suggest form, and to stimulate the designer's imagination and intuition, while avoiding overly doctrinaire and absolute solutions that might inhibit deisgn innovation.

To be accepted as a formal principle of design, an expressed design idea has to be a just representation of the goals and information at hand , and has to contribute to the provision of better environmental settings for the fulfillment of one or more developmental goals. This is the same as for Alexandrian patterns. But in addition, and herein lies the difference, principles are stated in an intentionally evocative way, suggestive of a whole class of specific solutions.

Two examples will illustrate the notion and its use.

Paced Alternatives

Problem and developmental goals. Environments with which the average child can cope are often frustrating or impossible for a child with reduced competence. The exceptional child should not be frustrated by the environment. On the other hand, the environment should have prosthetic qualities to suit special user groups but still provide enough challenges to stimulate and maintain activity.

Design principle. All play environments should have a variety of graded challenges and paced alternatives for children of varying abilities. Some challenges should be easy, while other challenges of the same play type should be more difficult (e.g., a gentle crawling ramp and a steeper set of stairs for the perceptual-motor handicapped child). The entire play environment should be designed to stimulate and advance children's skills but not put unreasonable demands on their ability if they can't keep up with the pace.

Justification. Children have a great need to gain self-confidence and a positive self-image, and this is often more difficult for the exceptional child than for the average child. Feelings and self-concept can be seriously damaged if children never reach goals which they set for themselves (McCandless and Evans, 1973). Maximum development results from an optimal discrepancy between the child's current abilities and demands put on him or her by the environment (Hunt, 1965)--challenges are made to existing motor, cognitive, and social schemes, motivating the child from one level of development to the next. Low self-concept reduces incentive to perform mental and motor tasks; to step up performance, children should be given tasks at which they can succeed--the success will lead them to attempt more difficult tasks (Cratty, 1974; Ayers, 1972). This required intensity of challenge has been called "the pacer" (Lawton, 1972; Rapoport, Note 5). Success at

such paced alternatives can also help to break the frustration cycle so sommon to exceptional children (St. Francis Center, Note 6). Therefore, graded challenge and paced alternatives assure the involvement of all children in play, motivate children to further development, and support a positive self-concept.

Insert Figures 6 - 8 about here

Supporting user requirements.

1. Small parts of the environment should provide challenge to develop long-range skills.

2. Challenge should be experienced in a variety of ways.

3. For each type of activity, there should be several levels of accomplishment, e.g., climbing steps, climbing a ladder, climbing a cargo net, climbing a fireman's pole, etc.

4. Play experiences should provide an awareness of challenges ahead without being intimidating--children should be able to see new challenges and accomplishment points ahead when completing a cycle of activities.

5. Interest and success mast be maintained by activities and space.

6. There should be some portions of the environment designed to the scale and skill level of infants as well as for children of all developmental levels up to 13 years of age.

7. Older children require less emphasis on balance, general coordination, and general physical activities; more emphasis should be placed on complex and paced cognitive challenges.

8. Play environments should provide for similar activities to occur at different rates without interfering with each other.

Example application. A design project was developed to implement this and other principles. The project was for the St. Francis Children's Activity and Achievement Center in Milwaukee, a center for exceptional children between the ages of infancy and about 10 years of age. A model outdoor play/learning environment was designed (see accompanying plan in Figure 9) and was summarized as a case study in design application.[4]

Insert Figure 9 about here

The principle of paced alternatives had a large influence on the design of an interconnected series of built structures on the west side of the site (left side of the plan). A central set of climbing towers adjacent to a sand pit unifies this area, with other built structures feeding out from them. This section includes a toddler area, a dual-functioning observation and play deck, a water play area with handicapped access, a maze, a loose parts building area (to be described below in more detail), a major integrated series of towers, large-muscle area, an emotional release area, a viewing tower, a social play area, and various levels of sand and rocks.

The central climbing towers were designed in response to a full range of motor skills and levels of confidence, and the children's need to develop a more positive self-concept. Applying the principle of paced alternatives to just one portion of this environment, that of the climbing tower and slides (see Figures 10 - 11), it became evident that several factors needed to be considered within this overall experience:

1. Climbing and entry points would have to accommodate different levels of motor skills. Height, pitch, and width of the slide would have to provide graded challenge. Similarily landing surfaces might need to vary from completely secure to more challenging.

2. Several modes of entry are possible in the structure illustrated,

offering the child a choice of difficulty. Simple stairs, pitched ladders, a climbing arch, and a rope rail up the slide require varying degrees of skill and confidence, but all provide access to the slides.

3. Three sliding surfaces vary in height, all allowing the whoosh feeling of sliding, but in varying degrees of "thrillingness."

4. Secure protective edges, wide platforms, and ample handrails and grips are provided at the junction points--those places where a child must reposition him or herself from the climb up to get into a sliding posture; confidence at these points is necessary for the child to continue with the challenge.

5. Air mattresses, mats, and sand are offered as alternative landing surfaces; the child can choose between the complete security of the softest air mattress landing, or the more challenging sand pit which requires some balance.

Insert Figures 10 - 11 about here

Loose Parts

Problem and developmental goals. Children learn spontaneously through active interaction with the environment around them, yet so many environments designed for children are static and rigid. One of the most important things about growing up is having the opportunity to experiment on the world, to change it, to see the results of these changes, and to learn from the total experience.

Design principle. In any play area for exceptional children, an area should be put aside for creative play with a variety of loose parts. The parts should be dynamic, interchangeable, and manipulable. There are three different types of loose parts: (a) manufactured objects in which the child

realizes an invariable finished form (e.g., a three-dimensional spatial puzzle); (b) a manufactured kit of parts in which the finished form is variable (e.g., a large, outdoor set of unit blocks, as shown in the accompanying illustration); and (c) discarded, natural, and found objects that can be used in any number of creative ways (e.g., tires, boards, spools, sand, gravel, material, old clothes, and props of various kinds).

Justification. Children need to satisfy their curiosity and to experience the pleaseure derived from discovery and invention. Through "unstructured play," children learn new skills, gain self-confidence, take pride in their achievements, build up a picutre of reality, sort out fact from fantasy, and extend their knowledge of the real world.

Children learn spontaneously through active interaction with the environment around them (Piaget, 1963), Children therefore need to be able to manipulate the environment around them.

Although handicapped children require special care and attention, they too can cope with and gain from a "rough and ready" atmosphere that is different from the usual supervised, structured play environment (Handicapped Adventure Playgournd Association, n.d.), and should be provided with a full range of challenging experiences which they can structure for themselves (Allen, 1968).

The most articulate statement of the need for manipulable or loose parts comes from the British designer, Simon Nicholson (1971) in a scholarly paper:

> There is evidence that all children love to interact with variables, such as materials and shapes; physical phenomena such as electricity, magnetism, and gravity; media such as gasses and fluids; sounds, music, and motion; chemical interactions, cooking, and fire; and other people, animals, plants, words, concepts, and ideas. With all these things all children love to play, experiment, discover

and invent, and have fun. (p. 30)

From this beginning, Nicholson has developed a theory of loose parts, which suggests, quite simply, the following:

> In any environment, both the degree of inventiveness and creativity, and the possibility of discovery, are directly proportional to the number and kind of variables in it. (p. 30)

A number of other writers have advocated the value also of loose, manipulable parts, including for exceptional children. Lady Allen of Hurtwood, a lifelong advocate for children and the founder of several adventure playgrounds for exceptional children, suggests that manipulative objects should be provided in all play spaces for exceptional children which will demand self-iniated activity (Allen, 1968). Lehman (Note 7) advocates offering unlimited opportunities for manipulation. Moran and Kalakian (1974) recommend the providion of at least two manipulative or loose parts areas in school buildings and playgruunds for handicapped children--one for advanced building systems and another for other manipulative and tactile experiences of a simpler nature. On the basis of his research on perceptual-motor problems in exceptional children, Kephart (1960) also recommends that children be able to perceive what a finished form might look like before actually constructing it. Ellis (1972) summarizes the argument:

> The essential characteristic for a playground is that it should elicit new responses from the child as he plays, and that these responses increase in complexity as play proceeds. (p. 4)

The principles of loose parts is an ideal design response to this essential characteristic.

Insert Figures 12 - 14 about here

Supporting user requirements.

1. Offer opportunities for manipulation.

2. Provide manipulative objects which demand self-initated activity (e.g., snad, dirt, informal loose parts, props, etc.).

3. Provide the opportunity for the child's awareness of a finished form before constructing it from a kit of parts (may even mean involving children in design and construction of the kit of parts).

4. Provide space and materials to build undertermined structures.

5. Provide manipulative and tactile experiences separate from the more advanced building area.

6. Include provisions for storage, activity space, and tools for children's use with found objects such as tires, boards, bricks, etc.

7. Provide exceptional children with manufactured sets of loose parts such as giant Tinker Toys, large outdoor modular blocks, etc.

8. Zone the play area so that high activity loose parts areas (e.g., an adventure playground for handicapped children) are away from less intense loose parts areas (e.g., a creative play area) and from quieter retreat and observational areas.

Example application. In providing loose parts in the St. Francis Center play environment, several factors needed to be considered. Children need to be able to handle a wide range of materials, to experience a wide range of textures, smells, forms, shapes, and plasticity, and to discover what different items can do. Ground surface materials, sand, gravel, bark chips, as well as water and plan materials, all respond to this principle and encourage creative play. Preformed construction sets and free-form building materials and tools are more difficult to provide, but can be provided and zoned into a designated loose parts area (see illustrations). The western interconnected play area--as well as each of the other areas

of the total play environment--provided several opportunities to include these features:

1. An extensive sand pit is centrally positioned allowing easy access and ample space for a large number of children to experience the special plasticity of sand play. An additional elelvated sand area allows barrier-free access for physically handicapped children.

2. A wide variety of water-play experiences is possible in the system of interconnected pools and water tables provided. Nearby storage is provided for cups, funnels, shovels, and other items for sand and water play.

3. A specially designated loose parts building area is set aside for more active construction with modular or free-form loose parts. Storage is again provided for tools and materials. The area is zoned away from quieter play areas and observation areas by being on the northwest side of the maze structure.

4. Landscaping throughout and surrounding the interconnected series of built structures provides numerous incidential loose parts in the way of leaves, twigs, and grass, and this is even more prevalent as the child moves east on the site towards the nature woods area.

Insert Figures 15 - 16 about here

Design Principles and Developmental Goals

As shown in the above examples, design principles are responses to developmental goals, and are derived by design articulations given to research information on child-environment relations. A complete set of principles for the design of environments for mentally and physically handicapped children is shown in Figure 17.

Insert Figure 17 about here

Summary

This paper has argued that it is possible to derive criteria for the better design of play/learning environments for exceptional children on the basis of existing research literature, especially in the child-environment area, as supplemented with information from other sources like observations of children and interviews with professionals involved in exceptional education. The paper has further argued that a powerful and scientific way of presenting these design criteria is in the form of testable design principles. They are powerful in that they provide the designer with wide latitude for creative design, and yet provide him or her with a conceptualized statement and image about certain characteristics of the exceptional child's environment thought to be important to development. They are scientific in that they are testable, and thus are open to both corroboration and falsification in the light of an empirical study either in a laboratory setting or a natural field setting. As illustrations of this notion, two design principles were presented together with their supporting data and arguments. The design principles are based on a theoretical conception of the exceptional child and his or her interaction with the physical environment. This conception holds that active commerce with the environment is critical to development, that all children--exceptional or not--pass through the same developmental stages and thus that the general child-environment literature applies also to exceptional children in their settings, and that an adequate play/learning environment must provide a full range of opportunities for cognitive, social, and physical play.

It is absolutely amazing to this writer that the role of the space in

It is absolutely amazing to this writer that the role of space in the learning and development of exceptional children has not yet been studied systematically. Sensitive teachers all "know" how important the environment of childhood is, how it can facilitate or hinder the curriculum and activities planned for handicapped children, how the children themselves are often frustrated by the environment around them, and even in some cases how space can have a direct stimulus or therapeutic value. Empirical research on this topic is sadly lacking however. The above is only one way of thinking about space/behavior relations and clearly is influenced by our desire to develop somewhat better play/learning environments even before the last work is in from the research community. Other conceptual approaches to the child-environment relation in the context of exceptional children are needed, as are carefully designed empirical studies. One approach which fascinates us in this latter regard is to develop a program of research testing some of the many hypotheses between environment and development represented in Figure 17. Such a program could then lead also to new theory tailored to the special conditions of the exceptional child and the environment, and to design criteria which could be continuously and systematically updated.

Reference Notes

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Footnotes

This chapter is based on papers given at the 1979 International Conference of the Association for Children with Learning Disabilities, San Francisco, March 3, 1979, and at the Seventh World Congress of the International Playground Association, Ottawa, Canada, August 25, 1978. Both of these presentations were done in collaboration with Leland G. Shaw, to whom I owe my thanks. Much of the work underlying the chapter was developed in concert with my colleagues Uriel Cohen, Lani van Ryzin, Jeffrey Oertel, and other members of Team 699 at the University of Wisconsin-Milwaukee. Though I take full responsibility for the ideas expressed herein, I gratefully acknowledge their collaboration on the initial work.

[1] For the full set of design criteria and a case study showing the application of the criteria to a particular site, see Moore, Cohen, Oertel, and Van Ryzin, Designing Environments for Handicapped Children (1979).

[2] Our sincere thanks to Mr. Eli Tash, Sr. Joanne-Marie Kleibhan, and the staff of the St. Francis Center for their cooperation, interest, and encouragement throughout this project. Without their support and entusiasm, the project never would have been realized.

[3] These methods, both for deriving design-relevant information from published research literature, observation, and interview, and for translating it into design criteria, have been treated in a number of earlier papers. See Cohen, (1978) and Cohen and Moore (1977).

[4] The complete design case study is given in Moore et al. (1979).

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